The opinion in support of the decision being entered today
is *not* binding precedent of the Board

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JEROME S. HUBACEK,
ALBERT R. ELLINGBOE,
and
DAVID BENZING

Appeal 2007-0127
Application 09/749,916
Technology Center 1700

Decided: May 25, 2007

Before: TEDDY S. GRON, JAMES T. MOORE, and MARK NAGUMO, *Administrative Patent Judges*.

MOORE, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

The Appellants appeal under 35 U.S.C. § 134 (2002) from a final rejection of claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

The Appellants disclose as their invention a low-resistivity silicon electrode to be used in a plasma reaction chamber. (Specification, p. 3, ll. 9-10).

The broadest independent claim under appeal reads as follows:

> 1. A low resistivity silicon electrode adapted to be mounted in a plasma reaction chamber including a confinement ring which is used in semiconductor substrate processing, comprising:
>
> a silicon electrode comprising a showerhead electrode having a plurality of gas outlets arranged to distribute process gas in the plasma reaction chamber during use of the showerhead electrode, the electrode having a thickness of about 0.25 inch to 0.5 inch and an electrical resistivity of about 0.005 to 0.1 ohm-cm, the electrode having an RF driven or electrically grounded surface on one side thereof, the surface being exposed to plasma in the plasma reaction chamber during use of the electrode.

The prior art references relied upon by the Examiner in rejecting the claims on appeal are:

Saito	US 5,993,597	Nov. 30, 1999
Uwai	US 5,993,596	Nov. 30, 1999
Degner	US 5,074,456	Dec. 24, 1991
Murai	JP 02-20018	Jan. 23, 1990

The rejections under review in this appeal are as follows.

Claims 1, 4-10, 30, 38, 39, and 41 stand rejected under 35 U. S. C. §103(a) over Degner in view of Murai.

Claims 3, 21, 25, 27, 31, 33-37, and 40 stand rejected under 35 U.S.C. §103(a) over Degner in view of Murai and Saito.

Claims 1, 4-10, 30, 38, 39, and 41 stand rejected under 35 U.S.C. §103(a) over Murai in view of Degner.

Claims 3, 21, 25, 27, 31, 33-37, and 40 stand rejected under 35 U.S.C. §103(a) over Murai in view of Degner and Saito.

Claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41 stand rejected under 35 U.S.C. §103(a) over Saito in view of Degner.

Claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41 stand rejected under 35 U.S.C. §103(a) over Degner in view of Saito.

The Examiner contends that the combined teachings of the references would have made the claimed subject matter obvious (e.g., Answer, p. 4, l. 21- p. 5, l. 3), the motivation to combine can be found in the references and skill in the art generally (Answer, p. 24, l. 14- p. 25, l. 5), and the declaration evidence does not show unexpected results (Answer, p. 21, l. 7 - p. 22, l. 3).

The Appellants contend that the claimed subject matter would not have been obvious within the meaning of 35 U.S.C. §103(a). More specifically, for the multiple rejections the Appellants contend that the art lacks a motivation to combine (e.g., Br. p. 11, ll. 14-15), the cited references do not teach the claimed properties (e.g., Br. p. 10, ll. 8-9), and that the declaration evidence overcomes any prima facie case of obviousness (e.g., Br. p. 9, ll. 19-21).

We AFFIRM.

ISSUES

Have the Appellants shown that the Examiner has not established that the claimed subject matter would have been obvious to a person having ordinary skill in the art, viewing the references of record - Saito, Uwai, Degner, and Murai - in the context of the knowledge and skill of one of ordinary skill in the art?

If the answer to the first issue is no, then have the Appellants shown that the Examiner erred in determining that the rebuttal evidence does not establish the patentability of the claimed subject matter?

FINDINGS OF FACT

The findings here and elsewhere in this decision are supported by a preponderance of the evidence of record.

Appellant's Description

1. The specification describes a low-resistivity (< 0.1 ohm-cm) silicon parallel- plate electrode which can be mounted in a plasma reaction chamber and used in semiconductor processing. (Specification, p. 3, ll. 9-10).

2. The claimed electrode is a parallel-plate "showerhead" electrode which has a plurality of gas outlets arranged to distribute process gas in the plasma reaction chamber. (Specification, p. 3, ll. 16-17).

3. The specification teaches that the gas outlets in a parallel-plate showerhead electrode are distributed across the exposed electrode surface. (Specification, p. 3, ll. 18-19).

4. Parallel-plate showerhead electrodes are well known as desirable for use in plasma reaction chambers. (Degner, col. 2, ll. 2-7).

5. The Applicants' parallel-plate showerhead electrode is said to be mountable to a support member by an elastomeric conductive joint. (Specification, p. 3, ll. 25-26).

6. The Applicants' parallel-plate showerhead electrode is said to be able to form plasma by energizing process gas via radio frequency electromagnetic (RF) waves. (Specification, p. 4, ll. 26-29).

7. A silicon wafer is said to be etched with the plasma. (Specification, p. 4, ll. 26-29).

8. The specification teaches that the electrode according to the invention can couple power into the plasma more efficiently and with less heat build up. (Specification, p. 5, ll. 3-4).

9. The Applicants' electrode is said to be clamped to a support member by a plasma confinement ring. (Specification, p. 8, ll. 11-12).

10. The Appellants' confinement ring is said to be fabricated from a dielectric material, ceramic material, dielectric coated metal, or other material. (Specification, p. 8, ll. 21-25).

11. The confinement ring is said to cause a pressure differential in the reactor and increase the electrical resistance between the reaction chamber walls and the plasma thereby confining the plasma between the upper and lower electrodes. (Specification, p. 8, ll. 9-30; p. 9, ll. 16-19).

Degner

12. Degner describes the use of parallel plate plasma reactors for etching (col. 1, ll. 24-25).

13. Degner describes parallel plate showerhead reactors which introduce gas through the upper plate and generate etching plasma by applying RF energy across the two electrodes. (col. 1, ll. 42-45).

14. Degner teaches that the upper electrode should not generate large quantities of particles and should not release heavy metals or contamination into the zone between the electrodes. (col. 1, ll.59-63).

15. Degner describes an electrode assembly of "semiconductor purity" material having a substantially uniform thickness. (col. 2, ll. 30-32).

16. Degner teaches one of ordinary skill in the art to consider various factors during fabrication of electrodes and to optimize impedance, current capacity (for RF coupling), temperature capabilities (enduring plasma), contaminant content (avoid deleterious effects on plasma), and machinability (for showerhead effect) (col. 1, l. 49 - col. 2, l. 7).

17. Degner describes that it was conventional to use polycrystalline silicon for the upper electrode plate in the known reactors (col. 2, ll. 8-12).

18. Degner teaches that it is "often desirable" to deliver etchant gas through the upper electrode. (col. 2, ll. 2-4).

19. Degner describes an electrode assembly including a support frame in the shape of a ring bonded to a plate. (col. 2, ll. 37-39).

20. Degner's semiconductor plate is said to be "semiconductor pure" and free of trace contaminants. (col. 3, ll. 50-60).

21. Degner's plate can be formed from single crystal silicon. (col. 4, l. 14).

22. Degner teaches that the thickness and other dimensions of the electrodes are not critical and are selected based upon the dimensions of the

reactor, cost of the material, material erosion rate, and the like. (col. 2, ll. 21 - 25.)

23. Degner teaches that a plate most commonly is from 0.1 to 2 cm thick (0.039 inch to 0.787 inch). (col. 4, ll. 32-33).

24. Degner teaches other plates from 0.3 to 1.0 cm thick (0.118 inch to 0.393 inch). (col. 4, ll. 32-34).

25. Degner teaches a showerhead electrode which has apertures for introduction of reactive gases. (col. 4, ll. 45-49).

26. Degner's plate apertures are said to be laid out in a symmetrical uniform, usually circular profile to enhance properties (col. 4, ll. 49-54).

27. Degner teaches laying the apertures in order to "minimize non-uniformities in the thermal, electrical, and structural properties of the disc." (col. 4, ll. 53-54).

28. Degner describes a support frame bonded to the electrode plate. (col. 4, ll. 66-67).

29. Degner's support frame is said to have high thermal and electrical conductivity and low impedence. (col. 5, ll. 6-11).

30. Degner's support frame is described as being suitably made from graphite. (col. 5, line 16).

31. Degner's support frame, for circular electrodes, is an annular ring. (col. 5, ll. 22-26).

32. Degner describes a confinement ring 92 (Answer, page 23, lines 1-2).

33. Degner describes a first insulating ring 90 and a second insulating ring 92 around the outer periphery of the electrode assembly. (Degner, col. 8, ll. 40-42).

34. Degner's insulating rings are said to protect the support ring 14 from direct contact with the plasma and enhance the electrical field properties of the electrode plate 12 during use. (Degner, col. 8, ll. 42-45).

35. Degner describes electrically and thermally conductive adhesive materials for bonding the support frame to the electrode to form a ductile bonding layer. (col. 5, l. 68 - col. 6, l. 2, col. 6, ll. 36-43).

36. According to Degner, the support frame is bonded to the electrode adhesively to form a ductile bonding layer.

Murai

37. Murai describes an electrode structure for a plasma processor (Translation, p. 2, ll. 2).

38. Murai describes an electrode for use in parallel plate high frequency [RF] plasma processors. (Translation, p. 4, ll. 12-14).

39. Murai describes a silicon single crystal electrode with a resistivity of 0.1 ohm-cm or less. (Translation, p. 3, ll. 15-18).

40. Murai describes various embodiments of electrodes having a resistivity as "desired." (Translation, p. 5, ll. 8-12).

41. Murai teaches that arsenic doped silicon crystal can have a resistivity of 0.005 ohm-cm or less. (Translation, p. 5, l. 11).

42. Murai teaches a "utility" embodiment of from 1-0.001 ohm-cm. (Translation, p. 5, ll. 12).

43. Murai teaches that the amount of the doping gas supplied varies depending on the size of the chamber, number of sheets to be doped, speed of the doping process, and other factors. (Translation, p. 6, last 3 lines).

Saito

44. Saito describes a parallel plate plasma etching electrode. (col. 1, ll. 6-7).

45. Saito teaches that conventional electrodes wear down during plasma etching. (col. 1, ll. 20-25)

46. Saito describes a plasma electrode of single crystal silicon with holes of 0.5 mm bored into the electrode. (col. 3, ll. 15-18).

47. Saito describes multiple electrodes (Ex. 1-22, Tbl. 1, col. 3-4) with electric resistivities of 35, 15, 2, 0.1, 0.01, and 0.003 ohm-cm.

Uwai

48. Uwai describes a plasma etching electrode plate for etching a wafer. (col. 1, ll. 10-13).

49. Uwai teaches a thicker electrode is better than a thinner electrode for durability. (col. 2, ll. 62-63).

50. Uwai teaches avoiding thin, warpable sheet electrodes for durability. (col. 2, ll. 60-65).

51. Uwai describes keeping surface temperatures uniform across the plate of the electrode. (Id).

52. Uwai teaches that a thermally conductive, thick electrode plate effectively suppresses the fluctuation of surface temperature distribution and results in a uniform etching rate and a long life. (col. 4, ll. 27-36).

ANALYSIS

(I) The Rejection of Claims 1, 4-10, 30, 38, 39, and 41 under 35 U. S. C. §103(a) over Degner in view of Murai.

(IA) *Arguments regarding Claim 1.*

Claim 1 recites a silicon electrode for use in a plasma chamber having a confinement ring, comprising: a showerhead electrode having a plurality of gas outlets arranged to distribute process gas in the plasma reaction chamber during use of the showerhead electrode, an electrode thickness of about 0.25 inch to 0.5 inch and an electrical resistivity of about 0.005 to 0.1 ohm-cm, an RF driven or electrically grounded electrode surface on one side thereof exposed to plasma in the plasma reaction chamber during use.

The Examiner found that Degner describes a parallel plate showerhead electrode for use in a parallel plate plasma reaction chamber used in substrate processing. The electrode has a thickness of from about 0.1 to 2 cm, which is about 0.04 to about 0.79 inches. The electrode has an RF driven surface on one side which is exposed to plasma. Finally, the electrode has a graphite backing confinement ring bonded to the electrode. The Examiner found that Degner teaches all of the limitations of claim 1 except for the specified Claim 1 resistivity. (Answer, p. 4, ll. 6-14).

The Examiner found that Murai describes a low-resistivity electrode for use in a parallel plate plasma reaction chamber used in substrate processing. The Murai electrode has an electrical resistivity of less than 0.05 ohm-cm. (Answer, p. 4, ll. 16-20).

The Examiner concludes that it would have been obvious in light of Murai to produce an electrode in accord with Degner's teaching with an

electrical resistivity of less than 0.05 ohm-cm because such an electrode structure with that resistivity is known to be suitable for use in a plasma apparatus. (Answer, p. 5, lines 1-3).

The Appellants urge three principal grounds of error.

First, the Appellants urge that the Examiner has erred in that the combination of Degner and Murai does not suggest the thickness of the electrode. (Br., p. 10, l. 20 - p. 11, l. 3). The reason is that Degner teaches it is desirable to minimize the thickness of electrodes for expensive materials, of which single crystal silicon is said to be one. (Br. p. 10, ll. 22-24).

We are not persuaded by this contention. The Appellants have taken a single sentence of the Degner reference out of context. The entire paragraph of Degner describes the electrode thickness thusly:

> **The thickness and other dimensions of the electrode plate are not critical** and will be selected based on the dimensions of the reactor, cost of the material, machinability of the material, material erosion rate, and the like. **Usually, however, for expensive material it will be desirable to minimize the thickness of the electrode plate while providing sufficient material to permit extended use before thinning of the material requires replacement.** Most commonly, the plate will be in the form of a disc having a diameter in the range from about 12 cm to 32 cm, usually being in the range from about 15 cm to 25 cm. **The thickness of the plate will be in the range from about 0.1 cm to 2 cm, usually being in the range from about 0.3 cm [0.12 in] to 1 cm [0.4 in].**

(col. 4, ll. 21-34)(emphasis added).

We find that the entire paragraph, taken in context, suggests the appropriateness ("most commonly") of plates ranging from about 0.1 cm to 2 cm, (from about 0.039 inch to 0.787 inch) and from about 0.3 cm to 1 cm

(0.118 inch to 0.393 inch). This encompasses the claimed range of about 0.25 inches to 0.5 inches.

A prima facie case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art. *In re Geisler*, 116 F.3d 1465, 1469, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997).

The Appellants' argument that for reasons of economy one should use as thin a piece of material as possible wholly ignores the last part of the same sentence - "while providing sufficient material to permit extended use before thinning of the material requires replacement." In other words, Degner teaches not to waste excess material, but to use enough for a long life.

Thus Degner itself contradicts the Appellants' assertion that "neither Degner nor Murai suggests a low resistivity silicon electrode having the thickness range of about 0.25 inch to 0.5 inch recited in Claim 1" (Br., p. 11, ll. 8-10). Degner's commonly used range is 0.039 - 0.787 inch. Accordingly, the Appellants' argument is without merit.

The Appellants' second argument is that the Examiner has established no motivation for making Degner's electrode material from the doped material disclosed by Murai. (Br., p. 11, ll. 14-15). The Appellants base this argument on their observation that Murai discloses a highly doped electrode to avoid contamination, while Degner does not suggest doping a wafer in a plasma processing chamber. (Br., p. 11, ll. 14-23).

This argument is likewise not persuasive.

We observe that Degner does not specifically disclose the resistivity of the electrode material in the claimed range. However, Degner's

electrode must have resistivity. The Examiner relied upon Murai as teaching a suitable electrode (Answer, p. 5, ll. 1-3) in that Murai teaches that the "specific resistance of the silicon single crystal, in order to be used as electrode (2) [i]s, normally 0.1Ω-cm or less" (Translation, p. 5, ll. 8-10). The two references describe parallel plate plasma electrodes, and Murai teaches one of ordinary skill in the art what an electrode resistivity should be. We observe that the Appellants have not challenged the Examiner's finding that 0.1 ohm-cm is a normal resistivity for an electrode to have.

We find that the evidence supports a finding that one of ordinary skill in the art would have used an electrode having a normal resistance for this particular application. Murai teaches such a resistance in the same art. One of ordinary skill in the art would have found the implicit motivation to use Murai in the knowledge common in the art.

We therefore agree with the Examiner's conclusion that the combination would have been obvious. See, e.g., *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1367, 80 USPQ2d 1641, 1650 (Fed. Cir. 2006) ("Our suggestion test is in actuality quite flexible and not only permits, but requires, consideration of common knowledge and common sense"); *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1291, 80 USPQ2d 1001, 1004 (Fed. Cir. 2006) ("There is flexibility in our obviousness jurisprudence because a motivation may be found implicitly in the prior art. We do not have a rigid test that requires an actual teaching to combine ..."), cited with approval in *KSR Int'l v. Teleflex Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1385, 1398 (2007)

The Appellants' third argument is that neither Degner nor Murai recognized the cracking problem that was solved by the claimed 0.25 inch and thicker electrode. (Br., p. 11, ll. 10-13). As such, it is urged, the applied references could not have suggested a solution to the electrode cracking problem. We are not persuaded by this rebuttal argument.

The flaw in this argument is that the prior art may be combined for reasons which are not identical to that of the applicant to establish obviousness. See *In re Kemps*, 97 F.3d 1427, 1430, 40 USPQ2d 1309, 1311 (Fed. Cir. 1996), citing *In re Dillon*, 919 F.2d 688, 693, 16 USPQ2d 1897, 1901 (Fed. Cir. 1990)(en banc). Degner teaches a thickness range value for single silicon crystal to be used as an electrode. Murai would have solved a different problem for one of ordinary skill in the art, specifically - one who was confronted with the problem of looking for a useful resistivity for a single crystal electrode.

Weighing the evidence pointed to by the Examiner against the evidence pointed to by the Appellants in support of their respective cases, we conclude that the Examiner established a prima facie case of obviousness. To the extent the solution of the cracking problem is submitted as unexpected results, see our discussion of the Hubacek declaration, *infra*.

The Appellants' Rebuttal Evidence

The Appellants next contend that the evidence of unexpected results overcomes the rejection and consequently rebuts the prima facie case of obviousness. (Br., p. 12, lines 1-3). The evidence submitted was the Second Declaration by Jerome S. Hubacek filed March 29, 2005. According to the Appellants, there were 5 unexpected benefits: (a) reduced center-to-edge

temperature gradient; (b) increased lifetime; (c) reduced byproduct deposition behind the electrode; (d) reduced electrical resistance; and (e) increased plasma confinement. (Br., p. 12, ll. 8-11).

The Examiner disagrees with the Appellants' characterization of the evidence as "unexpected" and cites Uwai as rebuttal evidence that the results of thicker electrodes are expected. (Answer, p. 21, ll.13-17).

Whether evidence shows unexpected results is a question of fact and the party asserting unexpected results has the burden of proving that the results are unexpected. *In re Geisler*, 116 F.3d 1465, 1469-70, 43 USPQ2d 1362, 1364-5 (Fed. Cir. 1997). The evidence must be (1) commensurate in scope with the claimed subject matter, *In re Clemens*, 622 F.2d 1019, 1035, 206 USPQ 289, 296 (CCPA 1980), (2) show what was expected, to "properly evaluate whether a ... property was unexpected", and (3) compare to the closest prior art. *Pfizer v. Apotex*, 480 F.3d 1348, 1370-71, 82 USPQ2d 1321, 1338 (Fed. Cir. 2007).

First, we observe that the evidence is not commensurate in scope with the claimed subject matter. For example, the electrodes which were tested by Mr. Hubacek are said to have had electrical resistivities of "from about 0.005 - 0.02 ohm-cm." (Hubacek Declaration, p. 3, l. 12 - page 2, line 1.) Claim 1 recites a resistivity of from about 0.005 to 0.1 ohm-cm. All of the tests appear therefore to be clustered at the lowest edge of the claimed range. As to the thickness of the electrode, only two thicknesses, 0.25 inch and 0.35 inches were tested, less than half of the claimed range for thickness. The vast majority of the two claimed ranges is largely untested.

Moreover, no credible evidence or argument is presented showing that the limited evidence offered is representative of the entire range. As a consequence, the evidence is not commensurate in scope with the claimed subject matter.

Even were the evidence commensurate in scope with the claimed subject matter, we find it further unpersuasive for the following reasons.

(a) The Center-To-Edge Temperature Gradient

Mr. Hubacek testifies that he fabricated four showerhead electrodes of different thicknesses which each had a number of gas passages in them and a range of resistivities. He testifies further that he applied different wattages to them. The variables of his testimony are assembled in Table 1 below:

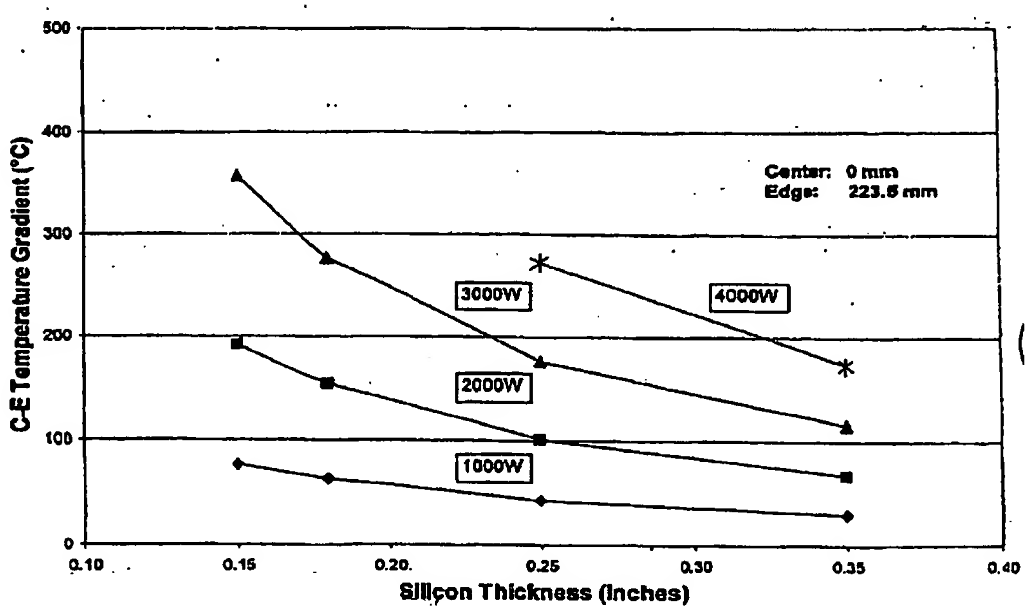
Table 1[1]:

Electrode	Thickness (inches)	Resistivity (ohm-cm)	Gas Passages (number)
1	0.15	0.005-0.02	3249
2	0.18	0.005-0.02	3249
3	0.25	0.005-0.02	3249
4	0.35	0.005-0.02	2437

[1] Table 1 illustrates electrode variables for four electrodes, including thickness, resistivity, and gas passages in columnar format.

The results of his testimony are presented as Appendix A to his declaration, which we reproduce as Table 2 below (slightly reduced):

Table 2[2]:



Mr. Hubacek testifies that the center-to-edge temperature gradient decreases as the showerhead electrode thickness increases. (Hubacek Declaration, p. 2, ll. 9-11).

We find this testimony to be unpersuasive as to the issue of obviousness.

First, we observe that Mr. Hubacek testified that the center-to-edge gradients for thicknesses of 0.15 inch, 0.18 inch, and 0.35 inches were "modeled" based on temperature measurements made for the showerhead electrode having a thickness of 0.25 inches. (Hubacek Declaration, p. 2, ll.

[2] Table 2 illustrates a graphical comparison of center to edge temperature gradient with silicon thickness at different wattages.

6-8). We are not informed what "modeled" means, or how the model affected the reported data. Was some data extrapolated? Or is all the data actual test results? The first few sentences of paragraph 2 of the declaration imply the latter, but the ambiguity in drafting the declaration leaves us in doubt and therefore we do not give this paragraph significant weight.

Second, Mr. Hubacek has not testified that these results were unexpected or surprising. We are not informed that a thicker electrode would not routinely have been expected to have a better thermal distribution because of, for example, its greater mass. (See, e.g. Uwai, col. 4, ll. 27-36). Nor are we informed what would have been the expected temperature gradient. Without knowing what was expected, we cannot assess the credibility of a statement that a given result was unexpected.

Third, the significance of the curves is unexplained. Was significant data analyzed and the distribution of results plotted to make a curve? Or do the curves simply connect four points, which may be actual data or modeled data? As there are only four points on the graph, we wonder whether the data could best be represented by a straight line. Consequently, we view the graphs with a degree of skepticism.

Finally, there are unexplained variables which have not been resolved in sufficient detail for us to credit this part of the declaration. For example, we have not been given any information on the significance of the differences in the numbers of the gas passages. We are not informed why a different number of passages were used and what effect this would have on the results. Also, we are not clearly informed whether the electrodes were used as intended, e.g., actually used in a plasma process, or whether a more

simple test was performed, and that the results would apply to the electrodes when used in a "real" process.

Moreover, the significance of the tested showerhead electrodes having an electrical resistivity "in the range of from about 0.005-0.02 ohm-cm" is unexplained. Some electrodes may have had resistivities as large as four times greater than others. The declarant has not explained what the specific restivities were, how they were measured, or whether these differences had any impact. In sum, the experiments appear to lack a control. See *In re Dunn*, 349 F.2d 433, 439, 146 USPQ 479, 483 (CCPA 1965) ("While we do not intend to slight the alleged improvements, we do not feel it an unreasonable burden on Appellants to require comparative examples relied on for non-obviousness to be truly comparative. The cause and effect sought to be proven is lost here in the welter of unfixed variables."). We therefore are not persuaded by these results.

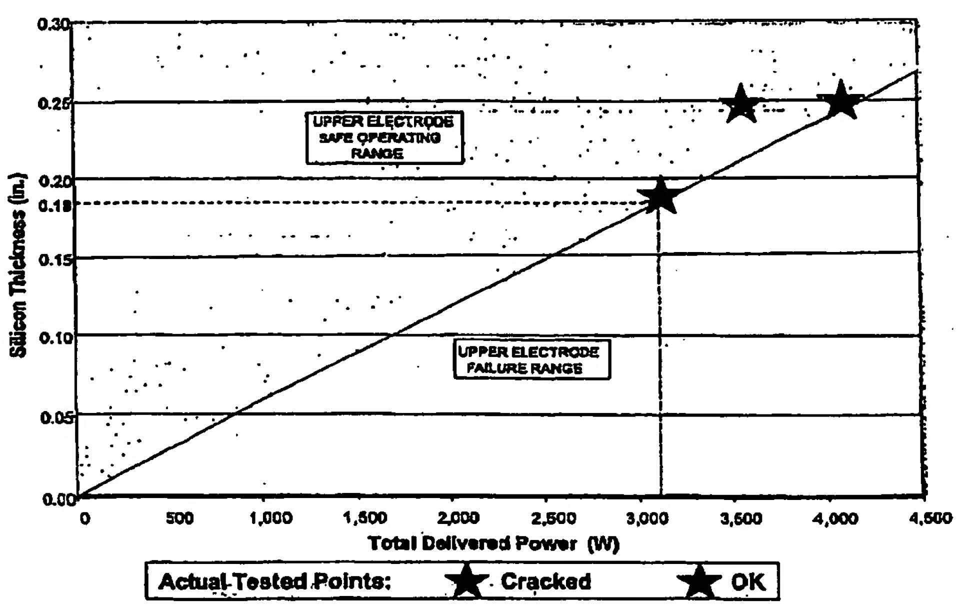
(b) Increased Lifetime and Operating Power

Mr. Hubacek testifies that the claimed showerhead electrode allows longer production times before replacement of the electrode is needed. He also testifies that this "unexpectedly provides better thermal uniformity" and allows an increase in the maximum amount of power that the showerhead electrode can be operated at without failure. (Hubacek Declaration, paragraph 3).

Mr. Hubacek also testifies that "showerhead electrodes having a thickness of 0.25 inches or greater can be operated at significantly higher power levels than thinner electrodes" (Hubacek Declaration, p. 3, ll. 10-11).

We find these explanations to be unpersuasive. Making a consumable electrode thicker would have been expected to make for a longer service life. As stated in Degner, quoted above, it is desirable to provide "sufficient material to permit extended use before thinning of the material requires replacement." (Degner, col. 4, ll. 27-29).

Mr. Hubacek relies on Appendix B as evidence of an "experimentally determined operating range in which the probability of electrode cracking is low." (Hubacek Declaration, p. 3, ll. 6-7). Appendix B is reproduced below as Table 3[3] (slightly reduced):



Mr. Hubacek asserts that the region above "line A" represents the experimentally determined operating range in which the probability of electrode cracking is low, and the region above line A represents the region in which the probability of electrode cracking is high. He then concludes that "[e]xtrapolation of line A to greater electrode thickness values shows

[3] Table 3 is a graphical representation of silicon thickness in centimeters versus total delivered power.

that showerhead electrodes having a thickness of 0.25 inch or greater can be operated at significantly higher power levels than thinner electrodes." (Hubacek Declaration, p. 3, ll. 6-11)

We have far less confidence than Mr. Hubacek that these three data points are sufficient to extrapolate the safe range and failure range. First, there is no visible difference in Appendix B between the "Cracked" and "OK" tested points. Second, line A is not marked on the graph, although we assume without deciding that it is the diagonal line, as that is the only line that makes sense to "extrapolate." Moreover, it would seem that a "cracked" point would lie well below line A; but the three "actual" tested points appear to lie well above (one point) or slightly above (two points) the line. Thus, all three points would seem to be in the low probability of cracking zone.

We are provided with conclusory statements that these results are "surprising" or "unexpected," without a substantive explanation of what makes them unexpected to one of ordinary skill in the art. Accordingly, we are not persuaded by this contention.

(c) Reduced Byproduct Deposition Behind the Electrode

Mr. Hubacek testifies that increasing the showerhead electrode thickness while using the same diameter gas passages "surprisingly reduces particle contamination of processed wafers." (Hubacek Declaration, p. 3, ll. 12-14). According to Mr. Hubacek, showerhead electrodes having a thickness of 0.25 inch and larger reduce deposition of polymer particles behind the electrode and this "can" provide a reduction in particle defects. (Hubacek Declaration, p. 3, ll. 12-14).

Other than these conclusory statements, we are not provided with any evidence to allow us to assess their probative value in a meaningful way. For example, how much reduction was observed? Were the tests run in actual plasma deposition tests? How many tests were run? Why is the increased gas pressure important? What is the margin of error? Why is this reduction surprising? Accordingly, we do not accord these conclusory statements significant evidentiary weight.

(d) Reduced Electrical Resistance

Mr. Hubacek testifies that the claimed showerhead electrode provides better RF coupling than thinner showerhead electrodes by decreasing the electrical resistance of the electrode from the center to the edge and resulting in a higher etch rate. (Hubacek Declaration, Paragraph 6, spanning pp. 3 - 4).

However, Mr. Hubacek does not testify that these results were surprising or unexpected. While the thicker electrodes may be better than thinner electrodes, the inquiry is whether the results were unexpected. Accordingly, we are not persuaded by this set of arguments.

(e) Increased Plasma Confinement

Mr. Hubacek testifies that the reduction in electrode resistance improves plasma confinement in the plasma reactor. (Hubacek Declaration, paragraph 4, spanning pp. 4 - 6.). Mr. Hubacek tested standard resistivity electrodes versus low resistivity electrodes. According to Mr. Hubacek, a larger confinement window results. Further "[s]uch performance benefits are highly desirable in semiconductor processing because by improving

confinement, the confinement window and the corresponding process window are increased" (Hubacek Declaration, page 6, ll. 1-3).

Assuming for argument's sake that the underlying facts as alleged by Mr. Hubacek are true, we still are faced with the fact that Mr. Hubacek has not stated that these results are unexpected or surprising, or why they would be so. Better is not necessarily unexpected or surprising. Accordingly, we are unpersuaded by the Appellants' evidence of unexpected results.

(f) Uwai describes the advantages of thicker electrodes

The Examiner has cited Uwai as evidence in support of the determination that the results were expected. According to the Examiner, Uwai shows that as a general principal a thicker electrode will have a smaller temperature gradient. (Uwai, col. 4, lines 27-36). (Final Rejection, p.21, ll. 1-5).

We also find that Uwai teaches an electrode plate should be thick rather than thin from the standpoint of durability (Uwai, col. 2, ll. 62-63) and that to keep the surface temperature uniform across the plate (ll. 52-53) thin warpable sheets should be avoided.

(g) Appellants' Arguments

The Appellants urge that despite their evidence, the Examiner "fails to provide any evidence suggesting that the probability of cracking of an electrode is reduced by making it 0.25 inch and thicker" (Br., p. 14, ll. 14-16). The Appellants also urge that Uwai "does not suggest that the glassy carbon electrodes can provide improved resistance to cracking" (Br., p. 14, ll. 20-21).

The Appellants' arguments are inapposite. The Examiner has established a prima facie case of obviousness. As we have discussed, the Appellants have failed to come forward with sufficient credible evidence to overcome that case. Even had we accepted the Appellants' arguments that unexpected results had been established for wafers 0.25 inches and thicker, that evidence would have to be weighed against the evidence of obviousness, including Uwai. The Appellants appear to have misunderstood the application of the Uwai reference. Uwai is relied upon as additional evidence to support the Examiner's position that the results pointed to by the Appellants are unexpected in that thicker electrodes generally are more stable. Uwai describes that principle to one of ordinary skill in the art. (Uwai, col. 2, ll. 62-63). Accordingly, we agree with the Examiner that Uwai tends to show that the results are expected.

The Appellants urge that the data points in Appendix B (Cracked versus OK) are sufficient because one of ordinary skill in the art could readily ascertain the trend in the data and reasonably allow him or her to extend its probative value. (Br., p. 14, ll. 5-8).

We disagree. There are only three data points on the chart, and without sufficient explanation to which line is "line A", or an indication as to which points define which results, the evidence is unpersuasive. If the two data points nearest the line are the only successes, then a rule is being extrapolated from the barest minimum of possible data. In any event, this argument goes to the weight to be accorded to the evidence, and we find that it is to be entitled to very little weight for the reasons discussed above.

Arguments Regarding Dependent Claims (6, 7), (30, 38), and (39,41).

The Appellants have argued the remaining claims in pairs as indicated by the parentheses.

(IB) Claims 6 and 7

The Appellants urge that Claim 6, which recites a resistivity of "less than 0.025 ohm-cm," and Claim 7, which recite an electrical resistivity "less than 0.05 ohm-cm," are patentable because Degner and Murai do not recognize the unexpected advantages provided by the electrode. (Br., p. 18, ll. 13-18).

As this argument is also premised on the Appellants' evidence of unexpected results, we are not persuaded by this argument for the reasons indicated above.

(IC) Claims 30 and 38

The Appellants urge that the combination of Degner and Murai does not suggest replacing Degner's electrode with Murai's doped electrode, or one with a thickness of about 0.375 inch to 0.5 inch and an electrical resistivity of less than about 0.1 ohm-cm as required by claim 30. (Br., p. 19, ll. 12-15). No specific argument is directed to claim 38.

We disagree. As discussed above, Degner's plate can be from 0.1 to 2 cm thick (0.039 inch to 0.787 inch) (col. 4, ll. 32-33) which substantially overlaps the claimed range of about 0.375 to about 0.5 inches. Further, the Examiner relied upon Murai as teaching a suitably resistive electrode (Answer, p. 5, ll. 1-3) in that Murai teaches that the "specific resistance of the silicon single crystal, in order to be used as electrode (2) [i]s, normally 0.1Ω-cm or less" (Translation, p. 5, ll. 8-10). The two references describe

parallel plate plasma electrodes, and Murai informs a person having ordinary skill in the art what a normal electrode resistivity should be. The Appellants argue that the claimed electrode provides enhanced resistance to cracking at high power levels, and a reduced electric resistivity. (Br., p. 13, l. 20 - p. 14, l. 11), However, as noted above, the Appellants have not established that the results relied upon are unexpected, and accordingly, we find them to have little probative weight in support of nonobviousness. We also note that none of the declaration results fall within the claimed thickness range of 0.375 to 0.5 inches (the thickest test was at 0.35 inches) and the absence has not been explained. Accordingly, the results are without significant probative value for claims 30 and 38.

(ID) Claims 39 and 41

Claim 39 reads as follows:

> 39. A plasma etch reactor comprising an electrode assembly including the electrode of claim 1 and a confinement ring.

Claim 41 reads as follows:

> 41. A plasma etch reactor comprising an electrode assembly including the electrode of Claim 30 and a confinement ring.

The Appellants urge for Claim 39 that the Examiner "fails to comment on the claimed confinement ring" (Br., p. 20, l. 14) and that the Examiner has "failed to identify any disclosure in Degner or Murai of a plasma etch reactor comprising an electrode assembly that also includes a confinement ring" (Id., ll. 16-18). The same argument is made for claim 41 on page 21 of the Brief.

This argument is baseless. In the Final Rejection, July 26, 2005, the Examiner observed that Degner described "a graphite backing confinement ring bonded to the electrode," citing Degner, col. 5, ll. 15-17. Degner describes annular rings of graphite from col. 5, ll. 5-35. Degner describes a first insulating ring 90 and a second insulating ring 92 being provided around the outer periphery of the electrode assembly. (Degner, col. 8, ll. 40-42). Degner's insulating rings protect the support ring 14 from direct contact with the plasma and enhance the electrical field properties of the electrode plate 12 during use. (Degner, col. 8, ll. 42-45). While Degner does not specifically use the term "confinement" ring, these structures and materials appear to be identical to the confinement rings described in the present specification at p. 8, ll. 9-30. They appear to function in the same manner as the claimed rings. The Appellants have not shown otherwise.

We therefore are unpersuaded by this argument of error.

(II) <u>The Rejection of Claims 3, 21, 25, 27, 31, 33-37 and 40 under 35 U.S.C. §103(a) over Degner in view of Murai and Saito.</u>

(II-A) Claims 3 and 27

Claim 3 reads as follows:

> 3. The electrode of claim 1, wherein the gas outlets have diameters of 0.020 to 0.030 inch and the gas outlets are distributed across the exposed surface.

The Examiner has applied Degner and Murai as in the previous rejection. Saito is relied upon for describing a parallel plate plasma apparatus having an electrode with bores said to be suitably sized and having diameters of 0.5mm (0.020 inches). The Examiner has concluded that it would have been obvious to make the outlets of the apparatus of Degner as

modified by Murai of the claimed diameter as Saito teaches that the dimension is suitable for a gas outlet of a showerhead electrode. (Answer, p. 6, ll. 10-16).

The Appellants urge that the claimed combination of Degner, Murai and Saito would have led away from the claimed subject matter of claim 3. (Br., p. 21, ll. 18-19). The Appellants base this argument on Saito's description of 0.5 mm apertures (Saito, col., ll. 15-16) as being within a 5 mm thick disc. (Id., l. 18). The Appellants urge that, as 5 mm is 0.20 inches, it is "significantly thinner" than the electrode of 0.25 inches as claimed. (Br., p. 21, l. 21).

This argument likewise is without persuasive merit.

First, each of the claims recite "about 0.25 inch to 0.5 inch." Asserting that "0.20" is "significantly" different from "about 0.25" without persuasive evidence of a relevant difference in some critical characteristic is merely an exercise in numerology. Secondly, the Appellants have not indicated how one of ordinary skill in the art would have been led away from the claimed range.

Finally, the appellants have made no argument whatsoever to claim 27, which requires the claim limitation of ultrasonically drilled holes.

Accordingly, we are not persuaded of error.

(IIB) Claims 21, 25, 31, and 37

Claim 21 covers low-resistivity showerhead electrodes with "the gas outlets having the diameter of ***about*** 0.025 inch to 0.030 inch" (emphasis added).

The Appellants urge that Saito fails to provide any motivation to modify Degner's electrode to include gas outlets having a diameter of from about 0.025 inch to about 0.030 inch. (Br., p. 22, ll. 22 – p. 23, ll. 3). This argument fails to address the description in Saito that establishes that gas holes in a showerhead electrode are known to have a suitable diameter of 0.5 mm (0.02 inch). It also fails to address the fact that the instant claims recite a diameter of "about 0.025" inch.

The Appellants have urged that this is a "hindsight" combination; however, the Appellants have failed to explain why 0.02 is neither the same as, or nonobvious in view of "about 0.025." The term "about" indicates some variability or "fuzziness" at the end point. We decline to construe it merely numerically. Practically, a diameter of "x" is "about 0.025" when an electrode with holes of "x" in diameter would perform substantially the same function. Saito stands as evidence that this would be the case. The Appellants' attorney arguments are not evidence. Thus, the preponderance of the evidence supports the Examiner's position.

Accordingly, we are not persuaded by this argument.

(II-C) Claim 33

Claim 33 reads as follows:

33. The electrode of claim 30, wherein the gas outlets have diameters of 0.020 to 0.030 inch and the gas outlets are distributed across the exposed surface.

The Appellants argument does not address the additional limitations of claim 33, but relies instead upon its argument that claim 30 was not properly rejected for lack of teaching as to the electrode thickness.

We have already rejected this argument as to claim 30, so we also reject it as to claim 33.

(IID) Claims 34, 35, and 36

The Appellants urge that, for these three claims, "the gas outlets have a diameter of about 0.025 inch to about 0.028 inch" (Br., p. 24, ll. 2-3, 9-10, and 15-16), and that the combination of Degner, Murai, and Saito does not disclose this feature. However, as discussed *supra,* the Appellants have not established that 0.02 inches is patentably distinct from "about 0.025" inch as recited in the claim.

Accordingly, we are not persuaded of reversible error on the part of the Examiner.

(IIE) Claim 40

The Appellants urge that claim 40, which depends from claim 21, recites the electrode assembly of claim 21 "and a confinement ring" (Br., p. 25, ll. 3-4). Substantively, we have already shown that this argument is factually incorrect and reject it again. Moreover, merely pointing out what the claims cover does not amount to an argument of separate patentability as required by Bd. R. 37 (c)(vii).

We therefore are unpersuaded by this argument of error.

(III) <u>The Rejection of Claims 1, 4-10, 30, 38, 39, and 41 Under 35 U.S.C. §103(a) over Murai in view of Degner</u>

The Examiner has found that Murai describes a low resistivity electrode (ref. num. 2) adapted to be mounted in a parallel plate plasma reaction chamber (ref num. 5) used in substrate processing, the electrode comprising a single crystal silicon electrode having an electrical resistivity

of less than 0.05 ohm-cm, the electrode having an RF driven surface on one side which is exposed to plasma. (Answer, p. 7, ll. 16-21). Degner has been found to describe a parallel plate electrode apparatus in which the upper electrode is low contamination, a showerhead, with a thickness of from about 0.1 cm to 2 cm, and bonded to a graphite backing ring. (Id., p. 8, ll. 3-6). Accordingly, the Examiner correctly concluded that it would have been obvious to modify Murai to include the showerhead of Degner to generate uniform plasma, and yield an electrode of high purity. (Id., p. 8, ll. 7-22).

Claims 8-10 simply recite a reactor including the electrode of claim 1, without adding material limitations defining the reactor. Accordingly, they appear not to add any new limitations.

(III-A) Claims 1, 4, and 5

The Appellants argue that Degner and Murai have substantial structural and functional differences, and combining them would substantially change the principle of operation. (Br., p. 26, ll. 4-7). The Appellants further urge that the claimed combination cannot change the principle of operation of the primary reference or render the reference inoperable for its intended purpose (Id., p. 27, ll. 3-5).

The test for obviousness involves consideration of what the combined teachings, as opposed to the individual teachings, of the references would have suggested to those of ordinary skill in the art. *In re Young*, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991); *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981).

We observe that claims 1, 4, and 5 are drawn to electrodes, and Murai is relied upon for teaching a resistivity range for electrodes. "[I]f a

technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR*, 127 S. Ct. at ___, 82 USPQ2d at 1396.

The Appellants have not explained why the allegedly different principles of operation mean that the resistivity teaching would not have transferred to Degner's electrodes. No persuasive evidence has been put forth by the Appellants to prove their argument, and accordingly they have failed to carry their burden of proof.

Accordingly, we are not persuaded by this contention.

Finally, the Appellants urge that the unexpected results presented in the Hubacek declaration rebut the prima facie case of obviousness. (Br., p.28, ll. 1-3). As discussed above, we are not persuaded by those results which are not probative of unexpected results.

(IIIB) Claims 6 and 7

The Appellants urge that the combination of Murai and Degner "does not recognize the unexpected advantages" of the low resistivity silicon electrode of claim 1, or the low resistivity of claims 6 and 7. (Br. p. 28, ll. 9-12). As we have determined that the test results do not establish nonobviousness as discussed above, we are not persuaded by this argument.

(III-C) Claims 8-10

Claim 8 reads as follows:

> 8. A plasma etch reactor comprising an electrode assembly which includes the electrode of Claim 1, the electrode comprising:
>
> a graphite backing ring elastomer bonded to the electrode; and

> thin beads of an electrically conductive elastomeric material between the electrode and the graphite backing ring, the elastomeric material including an electrically conductive filler which provides an electrical current path between the electrode and the graphite backing ring.

The Appellants urge that Murai and Degner fail to suggest substantially modifying Murai's plasma chamber to produce the plasma reaction chamber including a showerhead electrode as recited in claims 8-10 in light of the substantially different structure and principle of operation of Murai's apparatus. (Br., paragraph spanning pp. 28 - 29). By this, the Appellants appear to mean that the ordinary worker would not have modified Murai by changing the introduction of gases through the sidewall to introducing them through a showerhead electrode, as taught by Degner. (Br. at 27). The Appellants do not explain why the "principles of operation" are so different that the ordinary worker would not have tried to obtain the advantages of uniform plasma generation that are offered by showerhead electrodes.

We are not persuaded. As noted above, the Appellant has not shown by persuasive evidence or reasoning what principle of operation has been so changed as to render the teachings relating to the electrodes nontransferable.

(IIID) Claims 30 and 38

The Appellants urge that Murai and Degner fail to suggest modifying Murai's plasma chamber to produce a plasma reaction chamber including a showerhead electrode, much less a showerhead electrode having a plurality of gas outlets arranged to distribute process gas and a graphite backing ring elastomer bonded to the electrode. (Br., p. 29, ll. 9-18).

This argument is unpersuasive. Degner expressly discloses that it is desirable to form apertures or orifices through the plate in order to facilitate introduction of reactant gases into the reactor volume. The pattern will be circular, and laid out in a uniform symmetrical pattern. (Degner, col. 1, ll. 45-54). Degner also discloses a support annular ring (Degner, col. 5, l. 25), made of graphite (Id., l. 16), which is elastomerically bonded to the electrode (Id, col. 6, l. 67 - col. 7, l. 2). Furthermore, the Appellants have not indicated why these limitations render the claims separately patentable; see Bd. R. 37(c)(vii). Accordingly, we affirm this rejection as it applies to claims 30 and 38.

(III-E) Claims 39 and 41

The Appellants urge that the Examiner "fails to identify" the claimed confinement ring. (Br. p. 30, ll. 1-3). As noted above, this argument is incorrect. We affirm this rejection as to claims 39 and 41.

(IV) The Rejection of Claims 3, 21, 25, 27, 31, 33-37, and 40 under 35 U.S.C. §103(a) over Murai in view of Degner and Saito.

The Examiner has applied Murai and Degner as in the previous rejections, and further found that Saito describes a parallel plate plasma apparatus having an electrode with a plurality of bores having diameter of 0.5 mm (0.20 inch). (Answer, p. 11, ll. 3-7). The Examiner thus concludes it would have been obvious to one of ordinary skill in the art to make the apparatus of Murai modified by Degner and utilizing bores of the claimed diameter in the showerhead electrode because Saito teaches that the diameter is suitable. (Id., ll. 7-10).

(IV-A) Claims 3 and 27

The Appellants urge that the combination of Murai and Degner fails to suggest modifying Murai's apparatus to include a showerhead electrode, and Saito fails to suggest modifying Murai's apparatus "to include a showerhead electrode comprising the combination of features recited in Claims 3 and 27." (Br., p. 30, ll. 16-22). We are not persuaded.

First, the Appellants have not explained with any specificity what features of claims 3 and 27 are relied upon in making this argument. Secondly, the Appellants have not persuaded us that the Examiner's combination of references illustrating that each element of the claimed subject matter is either disclosed as conventional in the art or obvious in view of the art is in error.

The Appellants again urge that the Hubacek declaration contains unexpected results sufficient to overcome the evidence of obviousness. As we have previously found the Hubacek declaration to be entitled to little weight, we find that the prima facie case of obviousness has not been overcome.

(VI-B) Claims 21, 25, 31, 33, 34 35, 36, and 40

The Appellants urge that the claim elements of a showerhead electrode, namely gas outlets of from about 0.25 inch to 0.30 inch, an electrode thickness of from about 0.25 inch and 0.5 inch, and an electrical resistivity of less than about 0.1 ohm-cm, with a backing ring elastomer bonded to the electrode, render it patentable. The Appellants state that as the combination of references fails to provide a suggestion or motivation to modify Murai's apparatus to include a showerhead electrode with the gas

outlets. The Appellants also state that the combined teachings would not include every feature recited in claim 21. (Br., p. 31, ll. 7-21).

The Appellants also argue that the unexpected results of the Hubacek declaration are sufficient to overcome the *prima facie* case of obviousness. (Br., p. 32, ll. 1-3).

The Appellants fail to recognize that "[t]he suggestion or motivation to combine references does not have to be stated expressly; rather it 'may be shown by reference to the prior art itself, to the nature of the problem solved by the claimed invention, or to the knowledge of one of ordinary skill in the art.'" *Medical Instrumentation and Diagnostics Corp v. Elekta AB*, 344 F.3d 1205, 1221-22, 68 USPQ2d 1263, 1276 (Fed. Cir. 2003)(citation omitted).

In this instance, each claim element has been shown to be a standard value in the art for electrode type, aperture size, resistivity, and thickness. The art of parallel plate plasma etching of record, known to one of ordinary skill in the art, itself suggests these values for the variables. The Appellants have not shown any criticality to these claimed ranges.

Where general conditions of the appealed claim are disclosed in the prior art, it is usually not inventive to discover optimum or workable ranges by routine experimentation, and the Appellants have the burden of proving any criticality. *In re Boesch*, 617 F.2d 272, 276, 205 USPQ 215, 218-19 (CCPA 1980); *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). This they have failed to do.

The Hubacek declaration fails to overcome the evidence of obviousness in that it contains conclusory statements not supported by credible evidence for the entire scope of the claim. Moreover, in many

instances the declaration fails to indicate that the results are anything other than expected. Accordingly, we are not persuaded by this assertion.

As to claims 33, 34, 35, 36, and 40, the Appellants have recited the claim limitations without any argument for separate patentability. Accordingly, the Appellants have not persuaded us of error on the part of the examiner and we affirm this rejection, See Bd. R. 37(c)(vii).

(V) The Rejection of Claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41 under 35 U.S.C. §103(a) over Saito in view of Degner.

The Examiner found that Saito describes (Saito, col. 1, ll. 6-8) a low resistivity electrode in a parallel plate reaction chamber. The electrode is single crystal silicon having a resistivity of 0.0001-40 ohm-cm (Saito, col. 1, ll. 64-65, see also the specific examples in Table 1). The electrode is coupled to RF sources and exposed to plasma, and has bores in it of 0.5 mm (0.02 inch). (Examiner's Answer, page 12, lines 10-21).

The Appellants urge that the Examiner has arbitrarily selected a particular portion of Degner's range, which is much higher than Saito's disclosed thickness, while disregarding other portions of Degner's range that are below or above the thickness range recited in claim 1. Finally, the Appellants also urge that Degner teaches minimizing the electrode thickness.

As discussed above, Degner's thickness range (0.1-2cm) (0.039 inch to 0.787 inch) (Degner, col. 4, ll. 32-34) substantially overlaps the range of 0.25 to 0.5 inches recited in claim 1, rendering the Appellants' range selection obvious. Further, the teaching of minimizing the electrode thickness is for purposes of economy and Degner in the same breath states that the electrode should be thick enough to last (Degner, col. 4, ll. 28-29).

Thus, electrode thickness is recognized as being a result-effective variable. Accordingly, on the present record, the weight of the evidence indicates that selecting electrode thicknesses that fall in the Appellants' ranges would have been the result of optimization of result-effective variables. Such optimization is presumptively obvious, and the Appellants have failed to rebut the presumption. Thus, we are not persuaded of error on the part of the Examiner.

The Appellants set out in separate sections discussions of the claim elements of (1) Claims 21, 25, 31 and 37; (2) Claims 30, 33, and 38; (3) Claim 34; (4) Claim 35; (5) Claim 36; and (6) Claims 39 and 41. Simply reciting what a claim covers is not separate argument. Bd. R. 37 (c)(vii). To the extent these sections reiterate the argument that Hubacek overcomes the prima facie case of obviousness, that argument is unpersuasive for the reasons discussed above.

(VI) <u>The Rejection of Claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41 under 35 U.S.C. §103(a) over Degner in view of Saito.</u>

The Examiner found that Degner describes a single silicon crystal showerhead electrode for use in a parallel plate plasma reaction chamber, having a thickness of from about 0.1 to 2 cm and an RF driven surface on one side exposed to plasma and a graphite backing ring elastomer bonded to the electrode. (Degner, Figs. 3, 4 and Tbl. 1). Saito describes a parallel plate plasma apparatus having an electrode with resistivity as low as 0.001 ohm-cm (col. 1, ll. 65-65). See the specific examples of 0.003, 0.01, 0.1 in the table in columns 3 and 4. The Examiner concluded that it would have been obvious to one of ordinary skill in the art at the time the invention was made

to modify Degner's apparatus to use an electrode of electrical resistivity of less than 0.05 ohm-cm and a plurality of bores having diameters of 0.5 mm, as one of ordinary skill in the art would have been taught that such an electrode is suitable for plasma processing. (Answer, p. 16, l. 12 – p. 17, l. 16).

The Appellants urge that Saito discloses an electrode thickness of less than 0.2 inch, and Degner teaches to minimize electrode thickness. (Br., p. 38, ll. 16-20). As discussed above, this argument was unpersuasive. Accordingly, we agree that the Examiner has met the burden of establishing obviousness, and the Appellants have not shown any error.

The Appellants also urge that the results in the Hubacek declaration established unobviousness. (Br., p. 38, l. 21 – p. 39, l. 2). We have found the Hubacek declaration unconvincing for the reasons cited above.

The Appellants recite the limitations of (1) Claims 21, 25, 31, and 37; (2) 30, 33, and 38; (3) 34; (4) 35; (5) 36; (6) 39; (7) 40; and (8) 41 in separate headings from pages 39-42 of the Brief. For (1) and (3)-(8) above, we again observe that reciting claim elements does not constitute a separate argument for patentability.

For claims 30, 33, and 38 the Appellants argue that Saito's silicon sheet is "much thinner" than the electrode recited in claim 30. (Br., p. 40, ll. 10-11). The Appellants argue that Saito does not suggest modifying Degner's electrode to result in the claim 30 electrode of thickness of about 0.375 inch to 0.5 inch. (Id., lines 14-17).

We disagree. The claimed range of claim 30 is no thinner than the thickness disclosed by Degner as suitable. It is the combination of these two

references which render the claimed subject matter obvious. Degner, column 4, as noted above suggests the appropriateness ("most commonly") of plates ranging from about 0.1 cm to 2 cm, (from about 0.039 inch to 0.787 inch). The Appellants' claimed range is squarely within Degner's description and has been shown to be prima facie obvious on the present record . The Appellants have not come forward with convincing evidence of unexpected results.

Accordingly, we are not persuaded of error on the part of the Examiner.

CONCLUSION OF LAW

On the record before us, the Appellants have not shown that the Examiner erred in rejecting the claims under 35 U.S.C. §103 in view of the combined teachings of Degner, Saito, and/or Murai.

DECISION

The Rejection of Claims 1, 4-10, 30, 38, 39, and 41 under 35 U. S. C. §103(a) over Degner in view of Murai is AFFIRMED.

The Rejection of Claims 3, 21, 25, 27, 31, 33-37 and 40 under 35 U.S.C. §103(a) over Degner in view of Murai and Saito is AFFIRMED.

The Rejection of Claims 1, 4-10, 30, 38, 39, and 41 Under 35 U.S.C. §103(a) over Murai in view of Degner is AFFIRMED.

The Rejection of Claims 3, 21, 25, 27, 31, 33-37, and 40 under 35 U.S.C. §103(a) over Murai in view of Degner and Saito is AFFIRMED.

The Rejection of Claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41 under 35 U.S.C. §103(a) over Saito in view of Degner is AFFIRMED.

The Rejection of Claims 1, 3-10, 21, 25, 27, 30, 31, and 33-41 under 35 U.S.C. §103(a) over Degner in view of Saito is AFFIRMED.

AFFIRMED

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